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**Using Cognitive Interviewing to Better Understand  
Young Adult E-cigarette Use**

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**Using Cognitive Interviewing to Better Understand  
Young Adult E-cigarette Use**

**by**

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## **Dedication**

This is dedicated to my mother, the smartest and most compassionate person I know, and to Holly, for her patience and care.

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## **Abstract**

### **Using Cognitive Interviewing to Better Understand Young Adult E-cigarette Use**

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Questionnaires that assess emerging electronic nicotine delivery systems, or ENDS, are often based on traditional tobacco product surveys. Unique attributes of ENDS makes accurate assessment of their use a challenge for researchers. Cognitive interviews are a way of gaining insight into participants' interpretations of survey questions and the methods they use in answering survey questions. As part of a larger study, cognitive interviews were used to test a tobacco use survey that included ENDS questions with 25 young adults in Texas. By mapping results from cognitive interviews onto Tourangeau's four stage model of the survey response process, problems associated with survey questions were revised and then re-tested in multiple rounds of cognitive interviews. The four main areas of identified problems and attempts at question revision lay in improving the participant comprehension of the questions, the answer estimation processes, answer retrieval, and the answer response process.

Comprehension issues regarding discernment between ENDS device types appeared to improve when representative pictures were added to the survey showing the

type of device in question. Question comprehension and answer estimation processes both improved regarding using ENDS only as nicotine delivery systems when specific language that named nicotine cartridges and e-liquid as the content of devices was included in the question text. Regarding the answer retrieval process, results of this study showed that this sample of users had problems quantifying the amount of ENDS products consumed, as well as difficulty reporting the frequency of ENDS product use. The answer response improvement process allowed cognitive interview participants to add their own reasons for trying and using ENDS products to the list of available answer choices in multiple response questions.

Cognitive interviews offered insight into the new and rapidly changing landscape of ENDS products through in-depth conversations with users. Future research is needed that allows both users and researchers to quantify ENDS product use. Exploration into the wide array of ENDS devices as well as possible population differences among specific device-type users would be valuable to public health professionals. As a survey-improvement tool, cognitive interviewing provided valuable insight into survey interpretation that was otherwise inaccessible to researchers.

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## **Introduction**

Established surveys that assess traditional cigarette use include but are not limited to questions that measure quantity and frequency of use, dependence, and cessation success. Unique features of emerging electronic nicotine delivery systems, or ENDS, make these same assessments more challenging. Most surveys that assess ENDS use are based on traditional cigarette surveys, with modification based on ENDS characteristics. This study will describe challenges encountered in creating and implementing a tobacco use survey that includes ENDS assessment, and how cognitive interviews provided valuable insight into the rapidly growing and changing landscape of ENDS products.

### **ENDS PRODUCTS**

Electronic nicotine delivery systems are products that deliver vaporized liquid nicotine through a portable, handheld device. They are referred to by many names, among them “e-cigarettes,” “vapes,” and “e-hookah.” The first ENDS products were invented in 2003 (Foulds, Veldheer, & Berg, 2011) and made available in the United States (U.S.) in 2006 (Dawkins, Kimber, Puwanesarasa, & Soar, 2014). Multiple characteristics contribute to the growing popularity of ENDS products, among them appealing flavors (Choi, Fabian, Mottey, Corbett, & Forster, 2012), the ability to use ENDS products where cigarettes are prohibited (Foulds et al., 2011; Richardson, Pearson, Xiao, Stalgaitis, & Vallone, 2014), and a belief that ENDS are less harmful than traditional cigarettes (Etter & Bullen, 2011; Dawkins, Turner, Roberts, & Soar, 2013).

Electronic nicotine delivery systems span a wide range of complexity and size. The smallest and most familiar looking are “cigalikes,” products that are the same size and shape as traditional cigarettes. These products are often referred to as “first generation” e-cigarettes (Dawkins et al., 2014; Polosa et al., 2015). In cigalikes, liquid nicotine, which is suspended in propylene glycol or vegetable glycerin along with artificial flavoring, is vaporized and delivered after drawing on the device in the same manner as a cigarette (Dawkins et al., 2013). Some cigalikes are designed to be discarded at the end of the battery life or when the nicotine cartridge is empty. Other cigalike products are rechargeable and have replaceable nicotine cartridges available for purchase. In contrast, “vapes,” “vape pens,” or “e-hookah,” are ENDS products that come in a wide variety of sizes, including different tank volumes and varying battery voltages, and most with a button that activates the heating element prior to each use (Dawkins et al., 2013; Foulds et al., 2015). These products are often referred to “second generation” products (Dawkins et al., 2014; Polosa, 2015), and at the time of the current study’s implementation, offered higher levels of user customization and typically required a larger financial investment than cigalikes.

#### **ENDS AWARENESS AND USE**

The ENDS market is doubling yearly, and in March 2014 the U.S. retail market was estimated at over \$2 billion per year (Stimson, 2014). This rapidly expanding market is evident in the changing rates of awareness and use of ENDS products. Among those over 18, awareness of ENDS products rose from 40.9% in 2010 to 79.7% in 2013, 8.5%

of whom reported ever trying ENDS at least once (King, Patel, Nguyen, & Dube, 2015). Among adults, those aged 18 to 24 report the highest ENDS product use (McMillen, Maduka & Winickoff, 2012; Regan, Promoff, Dube, & Arrazola, 2013). Additionally, both current and former cigarette smokers have a higher rate of ENDS product use than never cigarette-smokers (Camenga et al., 2014; Etter & Bullen, 2011; McMillen et al., 2012; Pearson, Richardson, Niaura, Vallone, & Abrams, 2012; Regan et al., 2013). Research suggests that this greater use among smokers as compared to non-smokers is often as a replacement or substitution for cigarettes among those attempting to quit cigarettes (Adkison et al. 2013; Etter & Bullen, 2011; Foulds et al., 2011; Goniewicz, Lingas, & Hajek, 2013; Richardson et al., 2014), or used in conjunction with cigarettes or other tobacco products (polyuse) (Camenga et al., 2014; Dawkins et al., 2013; Pearson et al., 2014; Regan et al., 2013; Richardson et al., 2014).

#### **CHALLENGES IN ENDS MEASUREMENT**

Unique challenges are encountered when measuring ENDS use versus assessing traditional tobacco products. Among smokers of traditional cigarettes, nicotine intake varies based on individual smoking intensity, including puff and inhalation patterns (Farsalinos, Voudris, & Le Houezec, 2015; Scherer, 1999). While ENDS use likely varies in these same smoking intensity patterns, the absence of regulation of ENDS products permits an even greater variation in nicotine delivery. Lack of product standardization and multiple customization options can mean little product uniformity from user to user across devices. For example, ENDS users may choose multiple e-liquid tank sizes,

heating coils with adjustable settings, various mouthpieces, and a wide variety of battery sizes. Each of these attributes can lead to considerable differences in ENDS products as nicotine delivery systems (Cobb & Abrams, 2011; Dawkins et al., 2013). Additionally, users can choose to blend multiple “e-liquids” with varying nicotine concentrations, effectively creating custom patterns of nicotine delivery (Dawkins et al., 2013; Farsalinos et al., 2014). These variations in ENDS products make them difficult to assess compared to traditional cigarettes. Typically a cigarette is finished in one “sitting,” whereas an e-cigarette may be used for one or two puffs and put away for later use (Foulds et al., 2015). Research has shown that these characteristics contribute to increased frequency of ENDS use as compared to cigarettes, including use in more locations where cigarette smoking is not allowed (Dawkins et al., 2013; Foulds & Veldheer, 2011; Richardson et al., 2014). While frequency of use is often asked in surveys, a great challenge exists in quantifying the amount of e-liquid product consumed, whether in replaceable cartridge form or in milliliters of e-liquid in refillable vape devices. Accurate assessment of the entire landscape of ENDS use is essential in order to gauge trends and changes in use and to determine the potential value or risk of these products to public health. To date, however, few studies have tested the accuracy with which existing survey questions assess ENDS use. The present study extends existing research by testing a variety of ENDS questions, including reasons for ENDS use, quantity and frequency of use, as well as cessation and dependence upon ENDS products in a sample of young adults using cognitive interviews.

## **COGNITIVE INTERVIEWS**

Cognitive interviews are a method of pretesting a survey in a target population to determine how well survey questions meet their intended objectives (Beatty & Willis, 2007). In his volume on the subject, Willis (2005) describes cognitive interviewing as the evaluation of how respondents comprehend, process, and then answer survey questions. In the most accepted and widely used method of conducting cognitive interviews, researchers collect verbal material from participants regarding explanations of how they interpreted survey questions, elaborations of their answer construction or retrieval, and any difficulties participants encountered in answering survey items (Beatty & Willis, 2007).

According to Roger Tourangeau's four-stage model of the survey response process (Tourangeau, Rips, & Rasinski, 2000; Willis, 2005) participants typically give inaccurate or unreliable answers because they cannot understand the question (a problem with comprehension), use flawed strategies in creating their answers (judgement and estimation errors), cannot remember or do not possess the relevant information (errors in retrieval), or fail to find an appropriate option among the available answer choices (response errors). This four-stage model provided the framework for the present study.

## **STUDY PURPOSE**

The present study aimed to accurately capture ENDS use among the group with the highest prevalence of use of these products, namely 18 to 29 year old young adults. The original ENDS questions were modeled on existing national surveys and assessed

frequency and quantity of use, reasons for use, ENDS product dependence, and cessation outcomes for ENDS and other tobacco products. Cognitive interviews were used to determine disparities between the information that was intended to be captured and that which participants provided in regard to their ENDS use.

## **Method**

### **SAMPLE AND RECRUITMENT**

This study was conducted in the context of a larger project (Marketing and Promotions Across Campuses in Texas, or Project M-PACT), which examines longitudinal trajectories of tobacco and nicotine use and tobacco marketing exposure among 5,482 young adults. Study participants for Project M-PACT were recruited from 24 colleges in the four largest metropolitan areas of Texas (Austin, Dallas, Houston, and San Antonio) and initially ranged in age from 18-29.

Cognitive interviews were conducted prior to the first wave of data collection using a separate convenience sample of 25 college students in Austin, Texas. Participants were solicited for cognitive interviews by advertisements posted in the university's daily campus-wide events email, as well as by posting flyers in common areas at three local Austin-area community colleges. The aim was to oversample participants with at least some previous or current experience using cigarettes, ENDS products, or other alternative products like hookah or smokeless tobacco. Cognitive interview participants were ages 18-32 ( $M=22.1$ ,  $SD=3.2$ ), and approximately half were female (52%). Regarding race/ethnicity, 48% identified as non-Hispanic white, 16% as Asian, 12% as Hispanic/Latino, 8% as African-American, and 16% as another race/ethnicity or two or more race/ethnicities. Eighteen participants had ever tried ENDS products, while 10 participants had used them in the last 30 days. Only two of these participants had used



disposable/rechargeable devices, while the remaining 8 used refillable ENDS products in the last 30 days.

### **COGNITIVE INTERVIEWS**

Cognitive interviews were used to gauge the level of mutual understanding between the researchers' survey questions and the participants' interpretation of the questions. Interviewing techniques focused on the main categories for potential errors in Tourangeau's four-stage model of the survey response process: a) comprehension of the questions, b) answer estimation processes, c) retrieval of the appropriate information, and d) the final response action. Each of the cognitive interviews was conducted using retrospective probing, meaning the online survey was completed in its entirety before the interview began. Participants were encouraged to use the "think aloud" technique in order to verbally recall the thought process he or she used when answering each survey question (Willis, 2005). This process offered researchers first-hand insight into how the participant arrived at his or her response for each question.

Each of the cognitive interviews also included direct, tailored questions, or *probes*, about survey questions (see Table 1), which generated more precise information than think-aloud reporting and allowed researchers to compare responses to identical probes across interviews. These probes were established before the interviews began, and were either anticipated (asked of all participants) or conditional (asked only of some participants) (Willis, 2005). For example, the survey asked all participants if they had ever used an ENDS product, and only those 18 who answered affirmatively were next

asked how they generated answers to past 30-day use. Skip patterns in the survey meant non-users of ENDS were not asked follow-up questions about their use. Thus in the cognitive interviews, non-users were not asked the conditional probes associated with specific use questions.

In addition to collecting think-aloud responses and using prepared probes, cognitive interviewers employed spontaneous and emergent probes as new information was discovered with participants. Interviewers asked questions as they arose in conversation, thus these spontaneous and emergent probes were not previously decided upon. These dynamic probing techniques meant interviewers used discretion in deciding which probes were most appropriate during the conversation. No two interviews were therefore the same, but the insight they provided based on the uniqueness of each participant was considered invaluable (Beatty & Willis, 2007).

#### **COGNITIVE INTERVIEW PROCEDURES**

Participants arrived at the project office to complete a consent form and then an online survey, which was immediately followed by the cognitive interview. Interviews were conducted with one interviewer and one note taker present, and each participant was compensated with \$40 cash.

Survey questions were revised between “rounds” of cognitive interviews, a technique referred to as iterative testing (Willis, 2005). Round 1 consisted of 10 cognitive interviews, and all survey questions were included in these interviews. Questions identified as problematic during Round 1 were revised based on analysis of the

interviews, and then re-assessed in Round 2 (10 participants). Additionally, multiple response option questions from Round 1 were made “open-ended” for Round 2 to assure that appropriate answer options were available. For example, in Round 2 the question “I tried ENDS products because...” contained a text box in which participants could type the reasons they tried ENDS products. These answer choices and any further issues identified were re-examined and revised for Round 3, with five final participants. After Round 3, questions and answer choices were either deemed appropriate for inclusion or discarded from the survey.

Similar to prior research (Garcia, 2011), after each round of cognitive interviews the research team reviewed the generated notes and audio files to inform revisions. Problems with survey questions were categorized in each of the four elements of the four-stage model of the survey response process. The iterative testing method provided a means to “test” the question revisions to determine whether the identified problems had been resolved in each round. See Table 2 for the timeline surrounding survey development, review, revision, and implementation.

## **MEASURES**

Initially ENDS assessment was comprised of 30 questions (see Table 3) and attempted to assess multiple areas, including quantity and frequency of ENDS use, reasons for trying and using ENDS, and dependence and cessation outcomes for ENDS use. Questions were based on existing surveys including the Population Assessment of Tobacco and Health (PATH) survey (National Institutes of Health, 2013), the Youth Risk

Behavior Surveillance System (YRBSS), the Behavioral Risk Factor Surveillance System (BRFSS), and the National Youth Tobacco Survey (NYTS) (Centers for Disease Control and Prevention, 2012, 2013). It should be noted that a panel of nine experts in the field of tobacco control provided comments and feedback on the initial survey before cognitive interviews began, and revisions were made according to their recommendations.

## **Results**

Cognitive interview participants were probed on the confidence they had in their answers, as well as the level of difficulty encountered in answering the survey questions. Problems identified during cognitive interviews were mapped onto the four stage model of the survey response process, and revisions attempted to improve respondent comprehension, answer retrieval processes, answer judgement and estimation, and offer appropriate answer options in multiple choice questions. After cognitive interview analysis and question revision, five questions were removed for the final survey, 25 questions were revised, and 9 questions were added, resulting in 34 ENDS questions. See Table 8 for the final ENDS questions used in the survey.

### **ISSUES WITH QUESTION COMPREHENSION AND ANSWER ESTIMATION**

Question comprehension requires understanding terminology as well as establishing a shared, specific meaning between the question researchers are asking and that which participants believe is being asked (Willis, 2005). Answer estimation processes refer to the consideration a participant undertakes when choosing the level of disclosure he or she will use in answering a question, especially in regard to sensitive or private topics (Willis, 2005). Question comprehension issues arose in two primary categories during cognitive interviews: a) discerning between types of ENDS devices and b) understanding the content of ENDS products. Device content also created potential issues in the answer estimation process. Tables 4 and 5 include the revisions that were

made to questions in an effort to reduce confusion between device types and reduce estimation errors regarding ENDS product content.

**Discerning between ENDS types.** The survey specified two categories of ENDS products: “disposable e-cigarettes or e-cigarettes with a disposable cartridge,” and those which “required the addition of e-liquid/e-juice” (hereafter referred to as “disposable/rechargeable” and “refillable,” respectively). Of the 18 participants who were asked questions about their past 30-day use of these devices, four noted difficulty knowing which type of product the questions were addressing. One participant mistakenly answered questions about recent disposable/rechargeable use with his recent refillable device experience, noting “it was a little disorienting because at first glance I thought it was the same question.” When probed on this same disposable/rechargeable question, another participant said “all of my friends use those reusable ones. They all have...that reusable tub of juice, and the button.” This participant was also answering a question specific to disposable/rechargeable devices, but was using a description of the refillable e-liquid type. When asked about his past 30-day refillable-type use, another participant replied “I didn’t really understand; I thought I was repeating myself.” We discussed his refillable device use and he noted that his answer “was the same as before. I was answering [the disposable question] about my use with a vape pen....If we go back, I’ve probably only used that [disposable device] once.” Another participant originally answered that she had not used either ENDS type in the past 30 days. However, the

cognitive interview revealed that she had in fact used a disposable/replaceable device, but did not know what it was called.

In order to add clarity to questions regarding the two types of ENDS devices, the portion of the question that specified device type was underlined (“a disposable e-cigarette or e-cigarette with a disposable nicotine cartridge” and “a vape pen, personal vaporizer, or any other device”) for Round 2. When confusion still arose from participants who did not carefully read the question or could not discern the distinction, for Round 3 photographs representative of these two types of ENDS products were added. Phrases linking the questions to the photos were added: “E-cigarettes of this type are pictured below” for the disposable/rechargeable questions and “A device of this type is pictured below” for the refillable questions. After inclusion of the photographs, no participants reported any issues discerning the type of ENDS product the questions specified.

**ENDS Product Content.** Creating shared comprehension of the questions also required the inclusion of specific language regarding the physical content of ENDS products. One participant answered ENDS use questions based on a literal reading of the questions, in that she had *used* ENDS products, but not to consume nicotine. She noted “you can smoke dry herbs from the e-cigs as well. That kind of confused my answers. I’m being honest – when I smoke e-cigs it’s not tobacco. Mention e-cigs with nicotine or tobacco if that’s what you mean.” In her answer estimation process, she chose to disclose her ENDS use as a vehicle for marijuana intake. In order to bypass any issues with

disclosure of drug use and attempt to avoid a potential over or under-estimation of ENDS use by other participants, all ENDS questions were revised to indicate use of the product “as intended, i.e. with nicotine cartridges and/or e-liquid/e-juice,” between Rounds 1 and 2 (see Table 6). When probed on understanding of this added language, all remaining participants ( $n = 15$ ) in Rounds 2 and 3 were able to articulate the intent that ENDS use specifically meant as a vehicle for tobacco and/or nicotine delivery, not marijuana or other substances. This language appeared to eliminate any confusion regarding ENDS content while also eliminating potential answer estimation issues regarding disclosure of ENDS devices as vehicles for marijuana or other drugs.

#### **RETRIEVAL PROCESS**

The ability to answer survey questions requires the respondent possess the relevant information pertaining to his or her experiences. In the original survey, 12 questions attempted to assess frequency of ENDS use as well as the quantity of disposable e-cigarettes used and volume of e-liquid consumed (see Table 6). Participants were probed on their confidence in providing accurate answers and asked to describe their retrieval strategies in generating their answers.

**Frequency of use.** Eighteen ever-users were asked about their past 30-day use of any ENDS products. (“During the past 30 days, have you used any ENDS product (i.e. an e-cigarette, vape pen, or e-hookah), even one or two puffs?”) All 18 participants reported no trouble in answering this question, each of whom felt confident that the “yes” or “no” that they answered was accurate.



When survey questions asked participants to report the number of days they had used each of the ENDS devices, self-reported confidence in answers often diminished. Fewer students reported current use of disposable/replaceable devices, so only two participants were asked about the amount of disposable/rechargeable ENDS they used in a given day (“On those days, how many disposable e-cigarettes or disposable nicotine cartridges did you usually use per day?”). Both could confidently say that it was less than one cartridge. For a month’s time span, they felt less sure about how to quantify their overall use. In fact, one participant noted “if I add up all the times I’ve done it, it could add up to one.” In this case, the participant was referencing the entire amount of time he had ever spent smoking a disposable/rechargeable ENDS product. Eight participants were asked about the frequency with which they used refillable devices. Six participants were confident in their answers. Each of these participants had either used it one, two, twenty, or all thirty days. Two other participants reported less confidence in their answers of past 30-day use. One participant who described guessing his answer of seven days noted “I do it so casually, that I don’t really recall how many days.” The other participant guessed he used a refillable device three times in the past 30 days, and said “I just thought that I’ve only done it with friends, so I know it was then. I don’t use it as much [as cigarettes].” These questions measuring past 30-day frequency were kept in the final survey. Questions regarding the total amount of disposable/rechargeable devices used in the past 30 days were also kept in the survey.

**Quantity and concentration of liquid consumed.** In an attempt to assess the quantity of nicotine and e-liquid consumed, refillable-type users ( $n = 8$ ) were asked questions regarding the size of e-liquid bottles they purchased, number of bottles of e-liquid consumed, concentration of e-liquid, and their device's tank volume. Reported confidence in most of these questions varied.

Six participants were probed regarding the size of bottles purchased to fill their devices. Three participants reported they were fully confident in their answers because they picked the choice "I don't know." Of the three participants who chose bottle sizes, two reported little confidence in their answers. One said "I don't pay attention that much to the size of it," while the other noted "I don't even pay attention to how many milliliters it is; there is small, medium, large, and the extra-large one. It says the milliliters, but depending on the flavor and how much I like it, it will determine how big a bottle I buy." One participant felt confident that his report of a 30 milliliter bottle size was accurate. This question was removed from the survey before Round 3 of the cognitive interviews, which is why only six of the eight total refillable device users were asked these questions.

All six participants who responded to the question regarding number of bottles consumed per day were confident that the answer was "less than one." One participant noted that "I'm with a friend and they just used the bottle; we smoked as much as we could, like a big group." Others noted "I just remember the two times I've used it, and I know I didn't use the whole bottle" and "I've only used it once and it was [with] my friends." The survey also attempted to assess the total number of bottles used in 30 days.

Of the six participants who received this question, five felt confident that their answers of zero, one, or three were accurate. One participant, while reporting a higher consumption of e-liquid (8-10 bottles) also noted, “I get sick of a flavor quickly, so I’ll buy quite a few. I mix my own flavors. I’ve used it for two months but I don’t know if I’ve used an entire bottle yet.” These questions regarding bottles used per day and per month were discarded for Round 3 of survey testing and cognitive interviewing.

In an effort to more specifically establish an amount of e-liquid consumed, in Rounds 1 and 2 participants were asked the number of milliliters of e-liquid used each day. As an aide in estimating the number of milliliters they used, one of the expert reviewers suggested noting that approximately 20 drops of liquid equaled 1 milliliter (mL). The six participants who received this question all answered less than 1 mL or exactly 1 mL. When probed on the confidence they had in their answers, one participant stated it “was easy to answer; I’ve only had a little bit” while another noted difficulty with the question, saying “the drops [of e-liquid] are weird, because the bottles, when you squeeze them in, it’s a stream, not drops.” This question was also discarded for Round 3 of cognitive interviewing.

There was slightly more reported confidence in the e-liquid concentration question. All eight participants of the nicotine concentration question felt confident in their answer. Four attributed this confidence to the fact that they did not know and were able to select “I don’t know” as an answer choice. The remaining four reported concentrations of 6, 18, or 24 mg of nicotine per milliliter of e-liquid and found the

question easy to answer. It should be noted that there was no mechanism employed for verifying nicotine content of the products participants reported using. This question was retained for use in the final survey.

In an effort to estimate e-liquid consumption, in the final round of cognitive interviews questions were added about the tank size on the refillable device and number of times a user refilled the tank each day. Only one participant received these questions, and he was confident in his answer of “I don’t know” for tank size and the fact that he refilled it approximately once per day. Both of these questions were discarded after Round 3 and not used in the final survey.

#### **RESPONSE PROCESS**

The survey included questions that asked participants to indicate their reasons for choosing, trying, and using ENDS products and brands (e.g. “using ENDS products relaxes me;” “using ENDS products is healthier than smoking regular cigarettes”). Two frequently employed probes were “Are there any answer choices missing in this multiple choice response section?” and “Are there any answer choices here that did not make sense?” After Round 1, only one participant suggested an answer option to add to the question “Do you use your usual ENDS (i.e. e-cigarette, vape pen, or e-hookah) brand because...” This participant noted that he chose this brand because “my friends have them,” which was not originally an available answer choice. This answer choice was added for Round 3.

In order to ensure the available answer choices did not influence the response process for multiple response questions, answer options were made open-ended for the surveys in Round 2. Six reasons were given in cognitive interviews that did not already exist as answer options in the original questions for choosing an ENDS brand or trying ENDS products. These choices were added to both questions regarding reasons to try a particular brand first, as well as reasons to regularly use a chosen brand (see Table 7). After these answer options were added to the questions in Round 3, no participants reported any difficulty or suggested any additional answer options.

## **Discussion**

Cognitive interviews provided insight into the interpretations and perceived meanings participants had of the survey questions, as well as the level of disclosure participants might typically use in their responses. Each of the problems that arose in cognitive interviews was mapped onto one or more of the areas of the four-stage model of the survey response process, including question comprehension, answer estimation, answer retrieval, and the question response process.

### **QUESTION COMPREHENSION AND ANSWER ESTIMATION**

Adding photographs representative of the specific types of ENDS devices seemed to improve the ability of participants to discern between disposable/rechargeable ENDS products and refillable types. An early attempt at improving question comprehension by underlining question text seemed less effective than the photographs, presumably because participants were not reading the questions carefully enough, or because the language specifying the device type was still unclear. The PATH survey (National Institutes of Health, 2013) includes photographs of specific device types, and this practice proved valuable in the present study. Future research should therefore include photographs as a prompt and to make clear the type of device in question.

Participant comprehension of the survey questions was also improved when language was included regarding the content of ENDS products. Much like the practice of “blunting,” where cigars are used as marijuana delivery devices (Camenga et al., 2014; Delnevo, Bover-Manderski, & Hrywna, 2011; Soldz, Huyser, & Dorsey, 2003), ENDS

products may be used to deliver more than just liquid nicotine. One participant referred to her practice of using ENDS products to smoke marijuana in herb form, which supports limited research regarding the addition of cannabis to ENDS devices (Etter, 2015) and other vaporization tools (Van Dam & Earleywine, 2010; Malouff, Rooke, & Copeland, 2014). The addition of language that specifically named nicotine cartridges and liquid nicotine as the content of ENDS products allowed cognitive interview participants to comprehend that *using* ENDS products referred to use only as nicotine delivery devices, rather than marijuana or other drug delivery. Adding this clarification of the content of ENDS products also may help avoid potential issues in answer estimation regarding illegal drug use. Because the survey questions were conceptually framed around ENDS products as nicotine delivery systems, the attempt was to avoid under-estimation of ENDS use where sensitivity regarding drug use may have influenced the level of disclosure in answering ENDS questions. The goal was also to avoid over-estimation of ENDS use where “using” ENDS actually referred to ENDS as drug delivery systems. With language included that specifically qualified ENDS use as only for nicotine delivery, no participants reported trouble understanding the intent of these questions.

#### **ANSWER RETRIEVAL**

Cognitive interview participants often described difficulty in reporting the frequency of their ENDS use. While they reported confidence in their ability to report whether or not they had used any ENDS products in the past 30 days, they were less sure about the specific numbers of days they used either device type. It appears that users are

more confident when their answers report use of ENDS either very infrequently or very frequently. This is not surprising, as research regarding behavior recall supports the idea that rare or infrequent behaviors are enumerated specifically, while high-frequency events are subject to more general estimation strategies (Conrad, Brown, & Cashman, 1998). Other tobacco research shows a digit bias in recall of numbers of days in the past 30 days cigarettes are smoked, in favor of multiples of five (Harris et al., 2009), as well as number of cigarettes per day, in favor of round numbers (Klesges, Debon, & Ray, 1995). It is likely that casual or intermittent ENDS users are less likely to be able to accurately report how often they use the product as compared with rare or everyday users.

Assessment challenges were also prevalent when survey questions attempted to quantify the use of both device types. Eighteen participants had ever tried an ENDS product, 10 of whom were past 30-day users. Those 10 participants were asked about the specifics of their past 30-day use. Two participants had used disposable/rechargeable devices while eight used refillable devices. For disposable/rechargeable devices, questions pertaining to number of cartridges used each day and per month were kept in the survey, though few participants used these devices and there was very little variability in the responses. The nature of cartridge devices suggests that questions of how many cartridges used per day are relatively ineffective, since the answer is likely to be less than one. These disposable/rechargeable devices were less popular with the current sample, however, thus fewer questions regarding their use were explored. Future studies should



focus on these distinct types of ENDS products. Limited research suggests that committed ENDS users prefer second (Foulds et al., 2011, 2015), or even third generation devices (Polosa, 2015), and discovering the role disposable/rechargeable devices play in ENDS product initiation and use is yet to be determined.

Refillable devices provided similar assessment challenges, as few participants were able to confidently recall the size of bottles they purchased to fill their devices, the milliliters used per day, or the number of bottles of e-liquid they consumed each month. Much like disposable/rechargeable devices, all participants could report they used less than one bottle per day. The only question that was retained in the final survey pertaining to e-liquid was nicotine concentration, as more participants reported confidence in this answer, though exactly half reported “I don’t know.” It seems reasonable to assume that users pay more attention to their e-liquid nicotine concentration in an attempt to reduce or eliminate nicotine habits previously supported with cigarette use, or conversely as one user put it, to “make it hurt more...[to] make myself pass out from a dragon cloud.”

Cognitive interview participants also seemed unable to separate their individual use from use in a social or group setting. Similar to the social nature and social acceptability of hookah use among college students (Berg et al., 2015; Heinz et al., 2013), using ENDS products seems to be a social practice for some college students. Participants often referred to their ENDS use in the context of a friend or group, where devices were often shared.

## **RESPONSE PROCESS**

The most straightforward process of survey revision existed in adjustment of multiple choice questions that asked participants why they chose to use their brand of ENDS products. Probing on the applicability and clarity of multiple answer options and subsequently allowing participants to fill in their own answers provided valuable insight into their response process and proved useful in improving the survey. The final survey's questions included the original answer options, as well as those generated in cognitive interviews, and seemed to capture more of the salient reasons for use in our target population.

## **CONCLUSION, LIMITATIONS, AND STRENGTHS**

Cognitive interviews proved valuable both in shedding light onto the complicated and evolving nature of ENDS products, and in helping refine survey questions to specifically address intended objectives. The final survey is the accumulation of question revisions based on standard best practices, refined through in-depth discussions with ENDS users. The study has some limitations, however, and findings must be considered within the context of those limitations. First, in terms of quantifying ENDS use, the questions were limited in scope. Cognitive interviews did not yield great insight into the frequency of use or quantity of ENDS products consumed. Discussions with users revealed that they often did not know how much or how frequently they used ENDS products, especially refillable types (which were more popular among this sample).

While there is merit in demonstrating that many users do not know the frequency or amount of ENDS product they are using, it is clear that researchers need to develop survey questions that allow participants to accurately quantify their ENDS consumption. Second, like many qualitative analyses, data obtained in the interviews was open to interpretation and potential bias of researchers. Conducting more cognitive interviews and offering the survey to a larger numbers of participants could allow analysis of inter-rater reliability in identification of problem areas. More study participants would also allow a quantitative analysis of responses both before and after question revisions, to help determine the value added in changes based on cognitive interviews. Finally, this survey was developed and intended for widespread implementation among a large and diverse sample of college students in Texas. Conducting more cognitive interviews with more types of ENDS product users could potentially capture groups of users who may not have been represented in the current sample. While a great deal was learned about refillable devices from enthusiasts of these products, similar discussions with users who prefer disposable/rechargeable devices would be valuable in creating a survey better suited to the larger sample of the overall study and a wider range of ENDS users.

Future research would also benefit from focus group studies with ENDS users of various types, especially regarding third generation ENDS products, which are not specifically addressed in the current study. This fast-growing subgroup of products are often referred to as “mods” (an abbreviation of the word “modification”), and are refillable and customizable much like second generation devices, though they often

require knowledge of electrical concepts like resistance and Ohms law, and involve a larger financial investment than most other devices (Misthub, 2015). Online retailers often offer tutorials and videos to educate their customers on these products, however to date there is little to no research on the complexities of these devices. Similar to the challenges in assessment with first and second generation devices, mods offer a level of customization that will likely make quantification of their use difficult. It would be valuable to document the devices participants use, either through an invitation that they bring their preferred ENDS products with them to focus groups, or potentially upload photographs of their preferred devices while taking the online survey.

Despite the aforementioned limitations, the study has a number of strengths. Oversampling tobacco and ENDS users allowed focused conversations on a widely variable and emerging product for which there are a limited number of assessment instruments. Testing the survey in a sample of the population that reports the highest rates of use of ENDS products provided insight into the myriad of ways participants might interpret questions that assessment instruments had not yet included. Taking the time to test the survey instrument through cognitive interviews was invaluable to the survey generation process. Insight was gained into an emerging field of products, but even more importantly, a clearer understanding was gained of the answer processes young adult college students use when answering questions about ENDS use.

## Appendix

Table 1

*Prepared Probes Used in Cognitive Interviews*

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1. How did you come up with your answer?
2. How confident are you of your answer?
3. Were there answer choices here that did not make sense?
4. Are there any answer choices missing in this multiple choice?
5. Could you rephrase this question in your own words?
6. How easy or difficult was this question?

Table 2

*Iterative Testing Timeline: 2013 - 2014*

November 2013 – March 2014	March	May – July						October 2014
Survey Development	Expert Review	Round 1 ( <i>n</i> = 10)	Revisions	Round 2 ( <i>n</i> = 10)	Revisions	Round 3 ( <i>n</i> = 5)	Total ( <i>n</i> = 25)	Data Collection Begins

Table 3

*Original ENDS Items*

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1. Before this study, have you ever heard of an ENDS product (electronic nicotine delivery system)? (i.e. e-cigarettes, vape pens, or e-hookah?)
2. Have you ever used an ENDS product, (i.e. e-cigarette, vape pen, or e-hookah) such as Smoking Everywhere, NJOY, Blu, Vapor Kinds, Ruyan, Mystic, Logic, Fin, or 21st Century, even one or two puffs?
3. How old were you the first time you used an ENDS, (i.e. e-cigarette, vape pen, or e-hookah), even one or two puffs?
4. Have you used an ENDS (i.e. an e-cigarette, vape pen, or e-hookah), even one or two puffs, in the last 30 days?
5. During the last 30 days, have you used a disposable e-cigarette or an e-cigarette with a disposable cartridge? Neither requires the addition of e-liquid/e-juice.
6. On how many of the last 30 days have you used such a product?
7. On those (#) days, how many disposable e-cigarettes or disposable cartridges did you usually use per day?
8. How many disposable e-cigarettes or cartridges did you use in the last 30 days?
9. What brand of disposable e-cigarette or e-cigarette with disposable cartridges do you usually use? (Note: neither requires the addition of e-liquid/e-juice.) If you do not see your brand choice, please choose "other" and list it.
10. Is this e-cigarette flavored to taste like...? Check all that apply.
11. During the past 30 days, have you smoked a vape pen, personal vaporizer, or any other device that requires the addition of e-liquid/e-juice?
12. On how many of the past 30 days have you used such a product?
13. What was the size of the bottle in milliliters (ml) from which you obtained your e-liquid/e-juice in the last month?

14. What was the concentration of nicotine in milligrams/milliliter (mg/ml) of the e-liquid/e-juice that you used in the past month?
15. On the days you used the product in the last month, how many bottles of e-liquid/e-juice did you usually use per day?
16. On the days you used this device in the past month, approximately how many milliliters (ml) of e-liquid/e-juice did you consume on average in a given day? ( $\approx 20$  drops = 1 ml)
17. How many bottles of e-liquid/e-juice did you use in the last 30 days?
18. What brand of vape pen, personal vaporizer, e-hookah, or any other device that requires the addition of e-liquid/e-juice do you normally use?
19. Is this (brand) product that you normally use flavored to taste like...?
20. When you first started using any ENDS product (i.e. e-cigarettes, vape pens, or e-hookah), was it flavored to taste like...?
21. Think back to your first ENDS product (i.e. e-cigarette, vape pen, or e-hookah). What brand of ENDS did you try smoking?
22. Why did you choose this brand? Please check all that apply.
23. Which of the following situations best describes how you FIRST tried ENDS products (i.e. e-cigarettes, vape pens, or e-hookah)? Please check all that apply.
24. Which of the following describes why you TRIED ENDS (i.e. e-cigarettes, vape pens, or e-hookah)? Please check all that apply.
25. Please indicate by clicking the appropriate box the extent to which you agree or disagree with the following statements about ENDS products (i.e. e-cigarettes, vape pens, or e-hookah).
26. Have you ever bought or owned an ENDS (i.e. e-cigarette, vape pen, or e-hookah).
27. Do you intend to purchase any of the following flavors for your ENDS product (i.e. e-cigarette, vape pen, or e-hookah) in the next 12 months?
28. Do you use ENDS, (i.e. e-cigarettes, vape pens, or e-hookah) because... Please check all that apply.



29. Do you use your usual ENDS (i.e. e-cigarette, vape pen, or e-hookah) brand because... Please check all that apply.
30. Where do/did you usually get your ENDS (i.e. e-cigarettes, vape pens, or e-hookah) or e-juice? Please check all that apply.

Table 4




<i>Revisions Based on Comprehension Problems – Confusion Between Device Types</i>	
Original	Updated Language
1. Have you ever used an ENDS product, (i.e. e-cigarette, vape pen, or e-hookah) such as Smoking Everywhere, NJOY, Blu, Vapor Kinds, Ruyan, Mystic, Logic, Fin, or 21st Century, even one or two puffs?	Have you ever used an ENDS product, (i.e. e-cigarette, vape pen, or e-hookah) even one or two puffs?
2. Have you used an ENDS (i.e. an e-cigarette, vape pen, or e-hookah), even one or two puffs, in the last 30 days?	During the past 30 days, have you used any ENDS product (i.e. an e-cigarette, vape pen, or e-hookah), even one or two puffs?
3. During the last 30 days, have you used a disposable e-cigarette or an e-cigarette with a disposable cartridge? Neither requires the addition of e-liquid/e-juice.	During the past 30 days, have you used a <u>disposable e-cigarette or an e-cigarette with a disposable nicotine cartridge?</u> Neither requires the addition of e-liquid/e-juice. <u>E-cigarettes of this type are pictured below.</u>
	 
4. During the past 30 days, have you smoked a vape pen, personal vaporizer, or any other device that requires the addition of e-liquid/e-juice?	During the past 30 days, have you smoked a vape pen, personal vaporizer, or any other device with nicotine e-liquid/e-juice? <u>A device of this type is pictures below.</u>
	

Table 5

*Revisions Based on Comprehension Problems and Estimation Errors – Confusion Regarding Product Content*

Original Question	Updated Language
1 Have you ever used an ENDS product, (i.e. e-cigarette, vape pen, or e-hookah) such as Smoking Everywhere, NJOY, Blu, Vapor Kinds, Ruyan, Mystic, Logic, Fin, or 21st Century, even one or two puffs?	Have you ever used an ENDS product, (i.e. e-cigarette, vape pen, or e-hookah) <u>as intended (i.e. with nicotine cartridges and/or e-liquid/e-juice)</u> , even one or two puffs?
2 How old were you the first time you used an ENDS, (i.e. e-cigarette, vape pen, or e-hookah), even one or two puffs?	How old were you the first time you used an ENDS product, (i.e. e-cigarette, vape pen, or e-hookah), <u>as intended (i.e. with nicotine cartridges and/or e-liquid/e-juice)</u> even one or two puffs?
3 Have you used an ENDS (i.e. an e-cigarette, vape pen, or e-hookah), even one or two puffs, in the last 30 days?	During the past 30 days, have you used any ENDS product (i.e. an e-cigarette, vape pen, or e-hookah), even one or two puffs, <u>as intended (i.e. with nicotine cartridges and/or e-liquid/e-juice)</u> ?
4 During the last 30 days, have you used a disposable e-cigarette or an e-cigarette with a disposable cartridge? Neither requires the addition of e-liquid/e-juice.	During the past 30 days, have you used a disposable e-cigarette or an e-cigarette with a disposable <u>nicotine</u> cartridge? Neither requires the addition of e-liquid/e-juice.
5 During the past 30 days, have you smoked a vape pen, personal vaporizer, or any other device that requires the addition of e-liquid/e-juice?	During the past 30 days, have you smoked a vape pen, personal vaporizer, or any other device <u>as intended (i.e. with nicotine e-liquid/e-juice)</u> ?

- |   |   |
|---|---|
| <p>6 Think back to your first ENDS product (i.e. e-cigarette, vape pen, or e-hookah). What brand of ENDS did you try smoking?</p>                                     | <p>Think back to your first ENDS product (i.e. e-cigarette, vape pen, or e-hookah). What brand of ENDS did you try smoking <u>as intended (i.e. with nicotine e-liquid/e-juice)</u>?</p>                                |
| <p>7 Which of the following situations best describes how you FIRST tried ENDS products (i.e. e-cigarettes, vape pens, or e-hookah)? Please check all that apply.</p> | <p>Which of the following situations best describes how you FIRST tried an ENDS product (i.e. e-cigarettes, vape pens, or e-hookah) <u>as intended (i.e. with nicotine e-liquid/e-juice)</u>? Check all that apply.</p> |
| <p>8 Which of the following describes why you TRIED ENDS (i.e. e-cigarettes, vape pens, or e-hookah)? Please check all that apply.</p>                                | <p>I tried ENDS products (i.e. e-cigarettes, vape pens, or e-hookah) <u>as intended</u> because... Check all that apply.</p>  |

Table 6

*Revisions Based on Retrieval Issues*

	Original	Final
1.	Have you used an ENDS (i.e. an e-cigarette, vape pen, or e-hookah), even one or two puffs, in the last 30 days?	During the past 30 days, have you used <u>any</u> ENDS product (i.e. an e-cigarette, vape pen, or e-hookah), even one or two puffs, as intended (i.e. with nicotine cartridges and/or e-liquid/e-juice)?
2.	During the last 30 days, have you used a disposable e-cigarette or an e-cigarette with a disposable cartridge? Neither requires the addition of e-liquid/e-juice.	No change.
3.	On how many of the last 30 days have you used such a product?	No change.
4.	On those (#) days, how many disposable e-cigarettes or disposable cartridges did you usually use per day?	No change.
5.	How many disposable e-cigarettes or cartridges did you use in the last 30 days?	During the past 30 days, how many disposable e-cigarettes or nicotine cartridges did you use?
6.	During the past 30 days, have you smoked a vape pen, personal vaporizer, or any other device that requires the addition of e-liquid/e-juice?	No change.
7.	On how many of the past 30 days have you used such a product?	No change.
8.	What was the size of the bottle in milliliters (ml) from which you obtained your e-liquid/e-juice in the last month?	<b>Cut</b>

- |  |  |
|--|--|
| <p>9. What was the concentration of nicotine in milligrams/milliliter (mg/ml) of the e-liquid/e-juice that you used in the past month?</p>   | <p>During the past 30 days, what was the typical concentration of nicotine in milligrams/milliliter (mg/ml) of the e-liquid/e-juice that you used in the last month?</p> |
| <p>10. On the days you used the product in the last month, how many bottles of e-liquid/e-juice did you usually use per day?</p>   | <p><b>Cut</b></p>  |
| <p>11. On the days you used this device in the past month, approximately how many milliliters (ml) of e-liquid/e-juice did you consume on average in a given day? (<math>\approx 20</math> drops = 1 ml)</p> | <p><b>Cut</b></p>  |
| <p>12. How many bottles of e-liquid/e-juice did you use in the last 30 days?</p>   | <p><b>Cut</b></p>  |

Table 7

*Revisions Based on Response Process – Updated Multiple Choice Answer Options*

Original Question	Final Question
<p>1. Why did you choose this brand? Please check all that apply.</p> <ul style="list-style-type: none"> <li>- Because I thought it would taste good</li> <li>- Because it is a popular brand</li> <li>- Because my friends smoke this brand</li> <li>- Because I like the way this product looked</li> <li>- Because I like the advertising (e.g. magazine ad) for this brand</li> <li>- Because this brand is easy to find</li> <li>- Because I received a free sample or coupon for this brand</li> <li>- Other (please list):</li> </ul>	<p><u>I tried this brand first</u> (as intended) because... Check all that apply.</p> <ul style="list-style-type: none"> <li>- <u>This brand I known to be sturdy or durable.</u></li> <li>- It is a popular brand.</li> <li>- My friends use this brand.</li> <li>- I liked the way this brand's ENDS product looked.</li> <li>- I liked the advertising for this brand.</li> <li>- This brand is easy to find.</li> <li>- I received a free sample or coupon for this brand.</li> <li>- <u>This brand is easily refillable and/or reusable.</u></li> <li>- <u>This brand is known for a long battery life.</u></li> <li>- <u>This brand has easily adjustable settings.</u></li> <li>- <u>This brand is affordable.</u></li> <li>- <u>This brand of ENDS products is customizable.</u></li> </ul>
<p>2. Do you use your usual ENDS (i.e. e-cigarette, vape pen, or e-hookah) brand because... Please check all that apply.</p> <ul style="list-style-type: none"> <li>- You like the advertising?</li> <li>- This brand is easy to find?</li> <li>- This brand sends you coupons and/or gifts?</li> <li>- Other reason (please list):</li> </ul>	<p>I use this brand of ENDS regularly (as intended) because... Check all that apply.</p> <ul style="list-style-type: none"> <li>- <u>It is a popular brand.</u></li> <li>- <u>My friends use this brand.</u></li> <li>- <u>I liked the way this brand's ENDS product looked.</u></li> <li>- I liked the advertising for this brand.</li> <li>- This brand is easy to find.</li> <li>- I receive free samples or coupons for this brand.</li> <li>- <u>This brand is known to be sturdy or durable.</u></li> </ul>

- This brand is easily refillable and/or reusable.
- This brand is known for a long battery life.
- This brand has easily adjustable settings.
- This brand is affordable.
- This brand of ENDS products is customizable.
- Other



Table 8

*Final ENDS Items*

---

1. Before this study, had you ever heard of an ENDS product (electronic nicotine delivery system)? (i.e. e-cigarettes, vape pens, or e-hookah?)
2. Have you ever used an ENDS product, (i.e. e-cigarettes, vape pen, or e-hookah) as intended (i.e. with nicotine cartridges and/or e-liquid/e-juice), even one or two puffs?
3. How old were you the first time you used an ENDS product, (i.e. e-cigarette, vape pen, or e-hookah), as intended (i.e. with nicotine cartridges and/or e-liquid/e-juice) even one or two puffs?
4. During the past 30 days, have you used any ENDS product (i.e. an e-cigarette, vape pen, or e-hookah), even one or two puffs, as intended (i.e. with nicotine cartridges and/or e-liquid/e-juice)?
5. During the past 30 days, have you used a disposable e-cigarette or an e-cigarette with a disposable nicotine cartridge? Neither requires the addition of e-liquid/e-juice. E-cigarettes of this type are pictured below.
6. On how many of the last 30 days have you used such a product?
7. On those (#) days, how many disposable e-cigarettes or disposable nicotine cartridges did you usually use per day?
8. During the past 30 days, how many disposable e-cigarettes or nicotine cartridges did you use?
9. What brand of disposable e-cigarette or e-cigarette with disposable nicotine cartridges do you usually use? (Note: neither requires the addition of e-liquid/e-juice.)
10. Is your usual brand of disposable e-cigarette or e-cigarette with disposable nicotine cartridges flavored to taste like...?
11. I use this brand of ENDS regularly (as intended) because....Check all that apply.

12. During the past 30 days, have you smoked a vape pen, personal vaporizer, or any other device as intended (i.e. with nicotine e-liquid/e-juice)? A device of this type is pictured below.
13. On how many of the past 30 days have you used such a product?
14. During the past 30 days, what was the typical concentration of nicotine in milligrams/milliliter (mg/ml) of the e-liquid/e-juice that you used?
15. When you use a vape pen/personal vaporizer, do you usually use e-liquid/e-juice flavored to taste like...?
16. When you first started using any ENDS products (i.e. e-cigarettes, vape pens, or e-hookah), were they flavored to taste like...? Check all that apply.
17. Think back to your first ENDS product (i.e. e-cigarette, vape pen, or e-hookah). What brand of ENDS did you try smoking as intended (i.e. with nicotine e-liquid/e-juice)?
18. I tried this brand first (as intended) because... Check all that apply.
19. Which of the following situations best describes how you FIRST tried an ENDS product (i.e. e-cigarettes, vape pens, or e-hookah) as intended (i.e. with nicotine e-liquid/e-juice)? Check all that apply.
20. I tried ENDS products (i.e. e-cigarettes, vape pens, or e-hookah) as intended because... Check all that apply.
21. Please indicate the extent to which you agree or disagree with the following statements about ENDS products (i.e. e-cigarettes, vape pens, or e-hookah).
22. Have you ever bought or owned an ENDS product (i.e. e-cigarette, vape pen, or e-hookah).
23. During the next 12 months, do you intend to purchase any of the following flavors for your ENDS product (i.e. e-cigarette, vape pen, or e-hookah)?
24. I use ENDS products as intended because... Check all that apply.
25. Where do/did you usually get your ENDS (i.e. e-cigarettes, vape pens, or e-hookah) or e-liquid/e-juice? Check all that apply.
26. During the past 30 days, did you use any ENDS products (i.e. e-cigarettes, vape pens, or e-hookah) to try and quit cigarette smoking? Choose all that apply.

27. Have you ever successfully quit smoking cigarettes by using an ENDS product (i.e. e-cigarette, vape pen, or e-hookah)?
28. Have you ever felt like you really needed to smoke an ENDS product (i.e. e-cigarette, vape pen, or e-hookah)?
29. How soon after you wake up do you typically smoke your first ENDS product (i.e. e-cigarette, vape pen, or e-hookah)?
30. Have you ever had a strong craving for an ENDS product (i.e. e-cigarette, vape pen, or e-hookah)?
31. Do you want to completely stop smoking ENDS products (i.e. e-cigarettes, vape pens, or e-hookah) right now?
32. During the past 12 months, how many times have you stopped smoking ENDS products (i.e. e-cigarettes, vape pens, or e-hookah) for one day or longer in an attempt to quit?
33. How much do you agree or disagree with the following statements? "I think using ENDS products..."
34. How much do you agree or disagree with the following statements? "I think young adults use ENDS products to..."

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